

wind, as well as the forecasts of other elements that cause an increase in the number of forest fires.

REFERENCES.

- (1) Encyclopedia Americana, Vol. VII, Forestry in the United States
- (2) Signal Service Notes, No. 1, Report on the Michigan Forest Fires of 1881.
- (3) Meteorology, by W. I. Milham, p. 193.
- (4) The Thunderstorm and its Phenomena. MONTHLY WEATHER REVIEW, June, 1914, p. 348.
- (5) Elementary Meteorology, by W. M. Davis, p. 243.
- (6) Report on Wind Movements and their Relation to Forest Fires, by W. L. Merritt and W. J. Sproat (unpublished manuscript).
- (7) The Value of Weather Forecasts in the Problem of Protecting Forests from Fire. MONTHLY WEATHER REVIEW, February, 1914.
- (8) The Spell of the Rockies, by Enos A. Mills. 1911.
- (9) Forest Fires. Forest Service Bulletin 117.

634.0.4² HOW THE WEATHER BUREAU CAN HELP.*

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[Weather Bureau, Portland, Oreg., October, 1915.]

To estimate the probable intensity of a forest-fire hazard we need to begin our analysis of the weather as far back as the preceding October or November, especially as regards snowfall in the mountains. The destructive fires in 1910 were primarily due to a deficiency in snowfall during the winter of 1909-10, which was followed by a warm March that caused most of the snow to disappear by the 1st of April, or two months earlier than usual. The rains during the warm months that followed were light. The humus in the forest became dry, and fires were prevalent early in the year. They had obtained good headway in many localities long before the season for them had arrived.

During the winter of 1914-15 the snowfall was even less than in 1909-10, in fact, every report received last spring showed less snow on the ground than in the last 20 or more years. The beginning of this season was, therefore, more inauspicious than in 1910. They say the Lord favors the shorn lamb, and He must have had the lumber interests in mind when He gave the parched earth such bountiful showers last May and July (1915). It was the excess of rain in those two months that saved us from what might have been as bad a season for forest fires as any we have had in recent years. We were also favored by not having any very high winds to contend with during the height of the fire season, which did not really begin until August, and the worst part was over about September 10.

June, 1915, was drier than was June, 1914, in Oregon, Washington, and Idaho, and it was a little warmer in the first two States and a trifle cooler in Idaho. July, ordinarily dry, was a wet month in 1915, with 280 per cent of the normal rainfall in Oregon, 130 per cent in Washington, and 145 per cent in Idaho. July was also cooler than last year in all three States. If the following August had only followed July's example, we should have had no serious trouble with fires this year; but that month was not only about as dry as it was a year ago, but, in addition, it was considerably warmer. It was the fires started during this month that caused the greatest apprehension, and they taxed the fire-fighting strength under the control of some of your wardens and supervisors to their utmost.

Our forecasting in 1915 followed the same lines as in 1914, and while not up to the mark we have set for attainment, I am more convinced than ever the service is of help to the fire fighters, and it promises to be of value in lines not thought of before this season.

Three "sets" of fire-weather forecasts were issued—one in July, one in August, and one in September. The forecasts issued in September were verified in only a few places, while the others were fairly reliable, especially the one in August, which covered the worst period for fires in western Washington and northwestern Oregon (the territory to which it was limited).

Another way whereby the Weather Bureau can help those having charge of the work of putting out forest fires will be in the advice we are able to give regarding the daily weather conditions. If the fires are under such control that the conditions would be shaky if the winds increased, the question comes up whether to lay the men off or hold them for the contingency of high winds arising in the near future. Also we may have a local rain which would lead the man on the ground to believe all immediate danger has passed, and he would let his men go, when as a matter of fact the rain was insufficient and only temporary relief was obtained. Before he could get his men back losses might occur that would have been prevented if he had held them. In these small ways I feel sure we can be of help to those in doubt as to the procedure that should be taken.

Next year we hope to send "hot weather" forecasts to every post office in the neighborhood of forests, at least in the three Northwestern States. They will be printed on post cards and, besides the forecasts, will contain words of caution to campers and others who visit the forests about starting and putting out camp fires, etc. We hope that this card, issued in conjunction with the forecasts, will be posted in the country post offices and that it will help to impress the public with the importance of taking more care in these matters. Many fires obtain their start through sheer carelessness, and the public should have their attention called to preventative measures from as many angles as possible. The weather forecast will first attract the eye, and when the announcement "hot weather" is read the corollary of the increasing fire hazard will be impressed upon the readers by the accompanying notes on the caution that should be exercised by campers to prevent the spreading of their fires. If, through this card, only one "class C" fire is prevented it will much more than pay for the cost of the service.

Perhaps the most important step taken this year which will operate toward the efficiency of the fire-weather forecasts is the inauguration of nine lookout stations in the national forests of Oregon and Washington, which have been equipped with instruments for measuring and recording the velocity of the wind, the humidity, temperature, and rainfall. We hope the records kept at the high altitude of these stations will give information that will enable us to increase the time limit ahead of the occurrence of changes in the weather. This is important, for every hour in advance of a change to worse weather permits more preparation to avert the threatened damage.

* The United States Forest Service classifies forest fires, in its annual statistical statements, according to the area burned and designates the classes as follows:

Fires of class A are those covering less than one-fourth acre.

Fires of class B are those covering not more than 10 acres.

Fires of class C are those covering more than 10 acres.

Prior to 1912 fires of class B covered areas under 5 acres, and class C fires covered areas of 5 acres and over.—C. A., Jr.

* Extracts from paper "Fire-weather forecasts: where and how they prove effective," read before the Forest Industry Conference at San Francisco, Cal., Oct. 19, 1915.

The instruments for these lookout stations were furnished mostly by the Forest Service, which also supplies the men to operate the stations. The records are kept in accordance with Weather Bureau instructions, and copies are furnished my office for study purposes. We shall have to collect data for several seasons before we shall be sure just how they can be put in use to the best advantage, for one year's record is no criterion of what to expect the following year. The weather is never alike in any two seasons, but we can surely formulate certain postulates that will apply to all years.

The great advantage of the lookout stations is their elevation. They are all located nearly a mile above sea level, and the changes that take place in the weather

may first appear in any part of the circulatory system which includes both the high and low strata of the atmosphere. These stations are connected by telephone with trunk lines. Reports can be received from them almost at a moment's notice, and as often as required. This year only two of the lookout stations reported to our office, and while the observations were mostly negative in character the information was of value. As soon as we can compare the high-level with the low-level observations we shall have more data covering the third dimension of our problem, which heretofore we have attempted to solve on the basis of two dimensions, except as to the information obtained from the movement and character of clouds.